**Unit Plan overview covering 20 class room hours**

| **Lesson**  **(Title and topic)** | **Expectation**  **Codes** | **Lesson strategy and Assessment** | **Evaluation including criteria addressed** |
| --- | --- | --- | --- |
| **Diagnostic test- text**  (1 class room hour) | Review of Grade 11 Chemistry Curriculum | A series of questions from pg 158 - 159 of the textbook Nelson Chemistry 12 by Hans van Kessel et al. which test the  Pre-requisites to teach the unit “structure and properties”. | Teacher will collect the **tests** and grade them so that she can evaluate the level of the students.  Teacher can structure classes accordingly.  Survey of preferences and learning styles can be given at the beginning of unit to determine different multiple intelligences of students, heterogeneity of class and how the lessons will be adapted to suit their learning needs. |
| **Introduction to Structure and Properties**  (1 classroom hour) | C 1.1 | Videos of how chemistry relates to real life- careers and applications of molecular and atomic structures. This helps to increase interest in the topic.  <http://www.youtube.com/watch?v=5wkaIJTSZe0>  <http://www.youtube.com/watch?v=2O5PU3zB2OY>  <http://www.youtube.com/watch?v=vsP95aeLqLU&feature=related> | **Multiple choice**  (5 to 10 questions) about the video to ensure that students are engaged and comprehending. Teacher corrects the questions.  Students are to answer prompt question in their journal at the end of the video presentations. Questions will focus on future career aspirations, goals and what are the necessary steps they will take to achieve their future career dreams? |
| **Quantum Mechanics**  Past of atomic theory- Dalton, Thompson, Rutherford and Bohr, Schrodinger  And the future of the atomic theory(Bader) and (Leroy)  (2 Class room hours) | C 3.1 and C3.5 | So students would have to get into pairs **(think pair share),** research it in 30 minutes present it on chart paper and stick it on the time line prepared by the teacher.  The students and teacher **brainstorm** the contributions of the scientists in the past and the current Canadian scientists.  The class goes through to the last 20 minutes of the period in chronological order discussing the various scientific contributions made and leading up to present day Quantum Mechanics. Some discussion for the future can be addressed at this time also. | An **interview** where students get into pairs and interview the other students posed as scientists.  Teacher listens, observes and notes her observation by using a **scoring rubric** and checklists of the student’s knowledge through their answers in the interview.  Specific questions need to be addressed in order to achieve full marks i.e. 4+. |
| **VSEPR theory**  s, p, d and f Orbitals of all 20 elements  (**2 class room hours)** | C 2.3 and C 3.3  C 2.1 | Teacher **lecture** and **Demonstrate** the orbitals with the help of egg cartons. One egg container holds the s orbital, (pennies are used as electrons).  One penny needs to face upward, representing the “upward spin” and the other penny needs to face “downward”, representing the downward spin.  After teacher demonstrates, students get into groups of 3 and are assigned 5 to 6 different elements, then teacher uses **Chalk and talk** to explain any misconceptions and or questions the students encounter  Teacher **models and demonstrates** the shape of the orbitals by using balloons and knitting needles. Teacher shows the significance of the electron cloud and the “probability” that the electrons are formed in the region. A quick discussion on mathematical probability can be reviewed too before the details of the chemistry orbitals are discussed.  Teacher then gives the **balloons and needles** to students to practice in groups of 2-3. | **Exit ticket assessment –** Students have to pick up a piece of paper with the name of an element from a bowl and before they leave, they have to hand it in with the specific electronic configuration written down. Any element form the periodic table is fair game. Teacher prepares paper by cutting up the periodic table elements; all 105 of them to ensure all have the same chance of being picked.  Students are given specific **probability questions** from the text book chapter to ensure they understand electron probability and electron cloud distribution for the s, p, d and f orbitals. They would need to be able to explain all 4 orbitals and their respective electron clouds to a group of 3 other students the next day in class. |
| **Electronic configurations**  **(1 class room hour)** | C 2.2 and C 3.2 | Teacher revises Pauli’s exclusion principle, Hund’s rule, Aufbau principle with the help of **charts** and **posters** and gives student **practice problems.** | Teacher gives a short **quiz** to test knowledge of this topic. |
| Chemical Bonding  I**ntramolecula**r   * Ionic * Covalent * Polar * Non-Polar   **(2 class room hours)**  **Intermolecular**   * Vander waals * Dipole- Dipole * London dispersion * Hydrogen bonding   **(2 class room hours**) | C 2.4 and 2.5  C 2.4 and C 3.4 | Teacher explains bonding in a **seminar** involving an organized **role play** to explain the concept of sharing and transferring of electrons.  Example:   * Students can use their creativity, class notes, and text book to develop a skit on how this type of bonding occurs. Each skit will need to address: * What happens to the valence electrons? * What happens with the OCTET rule? * What happens after the valence electron moves? * What happens to the ATOM when the valence electrons move? * What are some examples of molecules, crystals, compounds that have your type of bonding?   1 pair of students to do IONIC Bonding  1 pair of students to do Pure COVALENT Bonding  1 pair of students to do POLAR Bonding  1 pair of students to do Non-POLAR Bonding  **GIZMO**  Teacher tells students to use Gizmos to learn about these topics from the URL:  <http://www.explorelearning.com/index.cfm?method=cResource.dspResourcesForCourse&CourseID=327>  Then, teacher arranges the first 4 topics above (IONIC, Pure COVALENT, POLAR, NON-POLAR COVALENT) on a spectrum based on each bond’s strength on the black board.  Teacher explains these forces by computer simulation using the **chemistry pod cast**  <http://www.youtube.com/watch?v=-ipttIAvvCk&feature=related>  and the url  <http://www.youtube.com/watch?v=gbPRKmSqugk&feature=related>  And then she asks students to partake in an **independent reading session** about the intermolecular forces and take down jot notes that they think are important. | They will be tested by a teacher based **moodle.**  She asks them to prepare a short **summary** with examples from the **jot notes** and she collects them for evaluation.  Students will be **peer evaluated and assessed** by teacher according to:   * Ability to personify atoms * Create dynamic presentation of transfer or sharing of electrons * Give examples of molecules that exhibit this type of bonding   Students are given questions that are specific to the IONIC bonding and COVALENT bonding Gizmo, to ensure they know how to use it and have become proficient and not “just playing around”.  Each student in the class is asked to pick from a bowl a card with a molecule, crystal or compound. They are to go to the spectrum on the board and place the card in the CORRECT location under the right type of bonding that takes place. After all the students have gone, the class will discuss the arrangement and move the cards around to show that some molecules have greater ionic or covalent characteristics depending on the electronegativities, atomic size, electron affinities, shapes of the atoms that make them up.  Teacher numbers off each student (#1-4) based on the number of intermolecular topics. Students then proceed to perform a **Jigsaw activity** where they focus on their intermolecular force that was assigned, and discuss in the expert groups the following:   * Is it a strong force? * What force is weaker or stronger? * Examples of molecules/atoms that have these forces? * Applications in real life   The expert groups go back to their home group and chare the information with all the other stuents that had been given the other forces. They write down all their knowledge on chart paper, using diagrams.  Students are evaluated on their **presentations** based on:   * Participation * Group cooperation and communications * Knowledge of material * Examples to emphasize topic |
| **Properties of Solids & Liquids**   1. Physical characteristics 2. Electrical conductivity 3. Surface Tension 4. Solubility 5. Melting points   **( 3 class room hours + 1 laboratory class**) | C 2.5 and C 2.6 and  2.4 | **Laboratory experiment** – where students compare the different properties of water, oil, homo milk, skim milk, salad dressing, salt, sugar, baking powder, Copper Sulphate , Epsom salts and prepare a lab report.  **Day 1:** Teacher demonstration on theoretical concept. Teacher performs a quick but very necessary demonstration of all the stations. Emphasizing the safety, equipment and method to perform the analysis. **Modeling laboratory procedures is crucial and necessary before all students can start!**  **Day 2:** Students are assigned and discuss procedure in small groups of 2-3 students. Teacher ensures that groups are heterogeneous and can work effectively together. Students perform the procedure using their lab book and the sheets at the stations provided. Students organize their strategy.  **Day 3:** Students perform their stations first for 8 minutes and at the sound of the bell are moved (rotate) to the next station. (5 stations X8 minutes = 40 minutes) | Each group gives a short **presentation** on their research so that teacher can facilitate a discussion.  Teacher corrects the **lab report.**  **Day 1:**  **Students are asked specific laboratory safety questions. Quiz on lab safety is given and discussed to ensure all students understand how all the equipment will be handled.**  **Day 2:**  Teacher evaluates their communication and cooperation style. Assessment of pre-laboratory flowchart, safety plan and emergency plan is performed in order to ensure all things run smoothly on the day of the lab.  **Day 3:**  Students are to hand-in completed laboratory experiment, with flowcharts, questions and checklists |
| **Applications related to analytical chemistry**  **(2 class room hours)** | C 1.2 | **Online Case studies** so that students can find out one career each that they want to pursue in relation to inorganic chemistry.  Students are to create a commercial of their career choice.  **Criteria for Commercial:**   1. URL of case study they need to find 2. Safety of the job they are interested in. 3. Financial compensation for career choice 4. Personal Satisfaction 5. Job contribution to society | Give them an assignment where we ask them to write a **short answer description** about the career of interest in inorganic chemistry that they plan to pursue and the specific details (skills, subjects,  Qualifications etc).  Based on the question they answered at the beginning of the unit.  Students are evaluated on how well they can defend or promote their career choice.  Checklist will be given  Peer and self-evaluation of how well they advertise their career choice. |
| We end with **culminating activity**  (1 class room hour for explanation of the culminating task, distributing instruction pamphlets and answering any questions + 1 class room hour for in class preparation in their groups + 1 class room hour for presentation)  \* The culminating task addresses one of the overall expectation of the chapter  “Assess the benefits to society and evaluate the environmental impact of products and technologies  that apply principles related to the structure and properties of matter.” |  | Students are given a **choice of the following** topics:   1. Chemistry in cooking i.e. cooking show 2. Chemistry in a spa or a beauty parlor 3. Chemistry in the media i.e. news or radio broadcast 4. Internet Blog or Internet Website creation of chemistry information 5. Court case drama that showcases how structure and properties of molecules and compounds are used in mystery scene investigations 6. Musical dance show 7. Role play   **Resources:**   1. Class text book 2. You tube video 3. Scientific journals 4. Encyclopedia   Interview person related to their presentation | Evaluate using a **rubric** and a **checklist** with **peer** and **self-assessment.**  **Students will be evaluated based on if they can prove they incorporated the following: (a checklist will be provided to ensure they understand what is necessary)**   1. Incorporate all theory learned in class 2. Submission of flowchart, mind map, graphic organizer of presentation 3. Journal and reflections of process of metagonitive thinking 4. Need to use at least 2 text books and 2 other resources |
|  |  |  |  |

**UNIT Culminating Task and Assessment Tools**  Prepared by: Petya, Sonya and André

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**1) Teacher Instructions**

In order to facilitate differentiated instruction, the teacher is to give students the choice of how they will present the theories, concepts and lessons learned during the Structure and Properties of Matter unit of SCH 4U.

In order to facilitate differentiated instruction, this project offers 7 different assessment activities, focussing on different aspects of the Gardner’s Multiple-Intelligence theory.  The students get to choose which activity they would like to take part in. As well, we recommend giving the students the opportunity to choose whether they would prefer working on this project alone or in pairs (both options are acceptable).

To maximize the benefits for the students, introduce the various components of the project to the students and let them contemplate for a day or two before asking them to sign up.  On sign-up day, they are to indicate whether they're working alone or in a pair, at which point you assign the student(s) the appropriate information pamphlet for their selected activity (make sure to have enough copies of them all).  
  
For the rest of that period, give the students time to brainstorm and start planning their activity, asking for a mind-map or other graphical representation (of their choice) before they leave. Also, ask each individual student to keep their own Progress Journal, recording their   
opinions on how the project is progressing, their challenges and their goals.  Ask them to complete a section every day, ensuring them that you will be the only person reading their journal.

After the initial choice is made, ensure to give the students at least one full work period to prepare their activity. Then, on activity day, each group will be given 10-15 minutes to present their activity, with assigned peer evaluations to be distributed to the class before each activity and to be picked up before the following one begins.

Assess each student based on the provided Grading Rubric.

**2) Expectations (*Structure and Properties of Matter, SCH 4U*)**

**Overall Expectations:**

C1. assess the benefits to society and evaluate the environmental impact of products and technologies that apply principles related to the structure and properties of matter;

C2. investigate the molecular shapes and physical properties of various types of matter;

C3. demonstrate an understanding of atomic structure and chemical bonding, and how they relate to the physical properties of ionic, molecular, covalent network, and metallic substances.

**Specific Expectations:**

C1.2 evaluate the benefits to society, and the impact on the environment, of specialized materials that have been created on the basis of scientific research into the structure of matter and chemical bonding (e.g., bullet-proof fabric, nanotechnologies, superconductors, instant adhesives) [AI, C]

C2.1 use appropriate terminology related to structure and properties of matter, including, but not limited to: orbital, emission spectrum, energy level, photon, and dipole [C]

C2.2 use the Pauli exclusion principle, Hund’s rule, and the aufbau principle to write electron configurations for a variety of elements in the periodic table [AI, C]

C2.3 predict the shapes of simple molecules and ions (e.g., CH4, SO3, O2, H2O, NH4 +), using the valence shell electron pair repulsion (VSEPR) model, and draw diagrams to represent their molecular shapes [AI, C]

C2.4 predict the polarity of various chemical compounds, based on their molecular shapes and the difference in the electro negativity values of the atoms [AI]

C2.5 predict the type of solid (ionic, molecular, covalent network, metallic) formed by a given substance in a chemical reaction, and describe the properties of that solid [AI]

C3.1 explain how experimental observations and inferences made by Ernest Rutherford and Niels Bohr contributed to the development of the planetary model of the hydrogen atom

C3.4 explain how the physical properties of a solid or liquid (e.g., solubility, boiling point, melting point, melting point suppression, hardness, electrical conductivity, surface tension) depend on the particles present and the types of intermolecular and intra-molecular forces (e.g., covalent bonding, ionic bonding, Van der Waals forces, hydrogen bonding, metallic bonding)

**3) Background Information & Prerequisites:**

A required prerequisite for the SCH 4U course is the grade 11 SCH 3U science course. Students require a strong background in the Chemistry strand of this course. Students need to know the periodic table, the trends of the periodic table and how the structures of the molecules and compounds affect the properties. More specifically, students must have a good foundation with the following overall expectations: C1, C2 and C3, also, the specific expectations C1.2, C2.1, C2.2, C2.3, C2.4, C2.5 and basic concepts 3.1.

Students would have also developed their understanding of chemistry concepts in their earlier general science classes. In this course, students further develop the understanding of chemistry and learn that elements and compounds have both physical and chemical properties that determine their functions, uses and their connections to society and the environment. In this course they would also learn that the use of elements and compounds have both positive and negative effects on society and the environment.

**Advance Preparation**

This course is an excellent university preparation course for students wishing to further study any of the sciences at the post secondary educational level. In this strand there are plenty of opportunities to integrate career exploration into the learning material.

The McGraw-Hill *Chemistry 11* textbook and the Nelson *Chemistry 11* textbook both outline a number of interesting career paths that the student may investigate further. When students take the senior chemistry course, they open themselves up to possibilities beyond their secondary level of education which can include (but are not limited to) study areas such as pharmaceuticals, medicine, research or teaching.

**4) Daily Breakdown, Details and Assessment**

| **Day & Time** | **Details** | **Handouts to Students** | **Assessment Tools** | **Assessment Tools**  **“for”, “as”, “of”** |
| --- | --- | --- | --- | --- |
| Prior to culminating activity  (20 mins) | Culminating activity hand-out is given prior to class to let the students choose their partners and the method in which they wish to deliver the presentation. | Culminating activity instructions, checklist and rubrics |  |  |
| **Day 1**  **(75mins)**  (10 mins.)  (55 mins.)  **Day 1 (continued)**  (10 mins.) | Students are allowed to choose how they will deliver the presentation. Therefore, they will have a voice in their preferred form of assessment. They inform the teacher of their group choice and their presentation method.  Students will be given a specific “pamphlet” with instructions which will detail the important aspects of their presentation style.  Each presentation will need to cover **at** **least 2 of the following lesson topics** covered during the Structures and Properties Unit:   * Quantum Mechanics * VSEPR Theory * Electronic Configurations * Intra-molecular Bonds * Inter-molecular Bonds * Properties of Solids & Liquids   Students will be asked to brainstorm ideas and research topics in class and will be required to submit a flowchart, mind map or other graphical organiser before the end of class.  Students will also be required to start a progress journal to record daily challenges, discoveries and ideas to improve their project. | **A pamphlet describing the procedure for their learning strategy choice. They can choose out of the following options:**   1. Discuss and display the types of chemicals you would find in an automotive mechanic’s shop and how their properties are used. 2. A cooking show that uses ingredients with a variety of chemical properties i.e. oil, water, salt, sugar etc… 3. Spas or beauty parlours all use specific chemicals that could be discussed in the presentation. 4. CBC News Report or Radio Broadcast of how chemicals are affecting the environment. 5. Mock court case between an environmental activist group and a multi-national pharmaceutical company. 6. Musical song and dance show that incorporates lessons seen in the unit 7. Dramatic role play incorporating the lessons learned and personifying the chemical theories and facts | 1. Flow chart, mind map or graphical organizer 2. Time is given for writing in their Progress Journal, which will be handed in at the end of the project. | “**as**” learning |
| **Day 2**  **(75mins)**  (10 mins.)  (55 mins.)  (10 mins.) | Research and preparation time to be given to class to allow for rich culminating experience.  Students need to outline which **key expectations** and lessons they will connect and incorporate into their activity.  **In the Computer Lab**  Research and preparation time to be given to students.  Students will be required to continue the progress journal to record daily challenges, discoveries and ideas to improve their project. | Checklist of Necessary Expectations | 1) Students must hand in their completed Checklist of Necessary Expectations.  2) Time is given for writing in their Progress Journal, which will be handed in at the end of the project. | “**as**” learning |
| **Day 3 (takes place one week after Day 2)**  **(75mins)** | **Presentations**. All groups will have approximately 10-15 minutes to present their topic to the whole class. Each group will be evaluated by their peers and will also have a chance to perform a self-assessment. | 1) Peer Evaluation  2) Exit ticket questions | 1. Peer Evaluation 2. Exit ticket questions 3. 1 page summary hand-out to be given to the class after their presentation. The handout is to be specific to group’s focus 4. Chart of Consulted Resources 5. Progress Journals | “**of**” learning |

**5) General Hand-out**

For this culminating activity to the Structure and Properties of Matter unit, you will have the opportunity to choose to perform one activity and presentation out of a list of 7 options. As well, you will have the option to work on this project solo or as part of a duo!

However, regardless of the option you select, you must make a clear link to what we have studied in class by including AT LEAST 2 of the following topics in your presentation:

* Quantum Mechanics
* VSEPR Theory
* Electronic Configurations
* Intra-molecular Bonds
* Inter-molecular Bonds
* Properties of Solids & Liquids

The method of presenting will be left to your discretion, although feel free to consult me if you have any questions.

I expect every presentation to last between 10 and 15 minutes.

As well, you will be asked to keep a personal Progress Journal that you will hand in on the day of your presentation. You are expected to write in this journal every day and comment on the progress of your activity, any challenges you’ve encountered and how you have surpassed them (or plan to) and any details you still need to iron out. This journal will only be read by me, so feel free to include any reservations, frustrations or, on the opposite end of the spectrum, any positive comments you care to.

I will also ask you to fill out a variety of forms, charts and assessments throughout the duration of the project as well. So don’t be surprised.

Once you have selected the activity you would like to undertake, you will be given an additional form with questions specific to that activity. This form is to be completed by you (or your partner if you work in pairs) and submitted to me. This form will be copied and distributed to your classmates after your presentation as a memory-helper for the important details of your presentation.

Work well together, see me with any questions and have fun!

**Mechanic’s Shop Names of group members: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
C:\Documents and Settings\pisanpet\Local Settings\Temporary Internet Files\Content.IE5\08QJ393P\MC900024380[1].wmfC:\Documents and Settings\pisanpet\Local Settings\Temporary Internet Files\Content.IE5\08QJ393P\MC900281764[1].wmf C:\Documents and Settings\pisanpet\Local Settings\Temporary Internet Files\Content.IE5\QSA24HG6\MC900230608[1].wmf**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1. **Where is a mechanic’s shop you can visit and / or call to interview the owner or worker?** |  |  |  |
| 1. **What types of chemicals are discussed in your presentation? i.e. motor oil, gasoline, brake fluid, etc.** |  |  |  |
| 1. **What are the molecular formulas of the key chemicals used or discussed?** |  |  |  |
| 1. **Justify the formulas using VSPER theory and Lewis structures** |  |  |  |
| 1. **Based on the molecular structures, what type of chemical bonding do the chemicals possess?** |  |  |  |
| 1. **What are careers that would relate to this topic presentation?** |  |  |  |
| 1. **How does your presentation tie your selected concepts into our society and the application to the real world?** |  |  |  |

**Cooking Show Names of group members: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
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|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1. **What cooking shows do you watch or can you interview a cook from a show or restaurant?** |  |  |  |
| 1. **What types of chemicals are discussed in your presentation? i.e. olive oil, water, salt, sugar, syrups, etc.** |  |  |  |
| 1. **What are the molecular formulas of the key chemicals used or discussed?** |  |  |  |
| 1. **Justify the formulas using VSPER theory and Lewis structures** |  |  |  |
| 1. **Based on the molecular structures, what type of chemical bonding do the chemicals possess?** |  |  |  |
| 1. **What are careers that would relate to this topic presentation?** |  |  |  |
| 1. **How does your presentation tie your selected concepts into our society and the application to the real world?** |  |  |  |

**A Spa or Beauty Salon Names of group members: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
   **

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1. **What spa or salon can you visit or interview an employee?** |  |  |  |
| 1. **What types of chemicals are discussed in your presentation? i.e. massage oil, water, alcohol, Epsom salts, stones, etc.** |  |  |  |
| 1. **What are the molecular formulas of the key chemicals used or discussed?** |  |  |  |
| 1. **Justify the formulas using VSPER theory and Lewis structures** |  |  |  |
| 1. **Based on the molecular structures, what type of chemical bonding do the chemicals possess?** |  |  |  |
| 1. **What are careers that would relate to this topic presentation?** |  |  |  |
| 1. **How does your presentation tie your selected concepts into our society and the application to the real world?** |  |  |  |

**CBC News Report / News Broadcast Report Names of group members: \_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_  
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|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1. **What news TV show or radio show can you visit or interview one of their employees?** |  |  |  |
| 1. **What types of chemicals are discussed in your presentation? i.e. carbon dioxide emission, green house gases, etc.** |  |  |  |
| 1. **What are the molecular formulas of the key chemicals used or discussed?** |  |  |  |
| 1. **Justify the formulas using VSPER theory and Lewis structures** |  |  |  |
| 1. **Based on the molecular structures, what type of chemical bonding do the chemicals possess?** |  |  |  |
| 1. **What are careers that would relate to this topic presentation?** |  |  |  |
| 1. **How does your presentation tie your selected concepts into our society and the application to the real world?** |  |  |  |

**Court Case Names of group members: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
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|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1) Is there an environmental activist group and /or multi-national pharmaceutical company you can interview |  |  |  |
| 2) What types of chemicals are discussed in your presentation? i.e. hydrocarbons, and pollution caused from manufacture. |  |  |  |
| 3) What are the molecular formulas of the key chemicals used or discussed? |  |  |  |
| 4) Justify the formulas using VSPER theory and Lewis structures |  |  |  |
| 5) Based on the molecular structures, what type of chemical bonding do the chemicals possess? |  |  |  |
| 6) What are careers that would relate to this topic presentation? |  |  |  |
| 7) How does your presentation tie your selected concepts into our society and the application to the real world? |  |  |  |

**Musical Song & Dance Show Names of group members: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
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| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1. Is there a singer and/ or dancer you can interview (they do not need to be famous)? |  |  |  |
| 1. What types of chemicals are discussed in your presentation? i.e. through a poetic song or rap. |  |  |  |
| 1. What are the molecular formulas of the key chemicals used or discussed? |  |  |  |
| 1. Justify the formulas using VSPER theory and Lewis structures |  |  |  |
| 1. Based on the molecular structures, what type of chemical bonding do the chemicals possess? |  |  |  |
| 1. What are careers that would relate to this topic presentation? |  |  |  |
| 1. How does your presentation tie your selected concepts into our society and the application to the real world? |  |  |  |

**Dramatic Play Names of group members: \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
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|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Answer** | **Resource where answer was obtained** | **Ideas for the presentation** |
| 1. Is there an actor or play writer you can interview (they do not need to be famous)? |  |  |  |
| 1. What types of chemicals are discussed in your presentation? i.e. through a dramatic characterization and personification. |  |  |  |
| 1. What are the molecular formulas of the key chemicals used or discussed? |  |  |  |
| 1. Justify the formulas using VSPER theory and Lewis structures |  |  |  |
| 1. Based on the molecular structures, what type of chemical bonding do the chemicals possess? |  |  |  |
| 1. What are careers that would relate to this topic presentation? |  |  |  |
| 1. How does your presentation tie your selected concepts into our society and the application to the real world? |  |  |  |

**7) Chart A: Presentation**

(Example of chart they need to complete for presentations)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Chemicals in presentation** | **Molecular formula and electronic configuration** | **Lewis structures – dot diagrams** | **VSPER – 3D structures** | **Intra-molecular Bonding Type** | **Inter-molecular Bonding Type** | **Physical properties** | **Electrical conductivity** | **Surface tension** | **Solubility** | **Melting Point & Boiling Point** |
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**8) Chart B: Checklist of Necessary Features**

To be used as a checklist to ensure the students have covered the necessary expectations, used appropriate resources and connected them to society, application and the real-world.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Lessons covered in Unit** | **Checkmark 2 or more concepts that you have chosen to include in your presentation** | **Resources to be used to facilitate research and gathering of information:**   * + Class text book   + Scientific Journal   + Encyclopaedia   + Interview person in company or expert   + Youtube video   + etc. | **Details that will be addressed during the presentation with respect to the lessons covered and how it directly ties in to society, applications in the real-world, etc…** |
| 1) | Quantum Mechanics |  |  |  |
| 2) | VSEPR Theory |  |
| 3) | Electronic configurations |  |
| 4) | Intra-molecular Bonding |  |
| 5) | Inter-molecular Bonding |  |
| 6) | Properties of Solids and Liquids |  |

**Appendix**

**EXIT Ticket Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**MC900233316[1]**

**1. Describe one new concept you learned today about the Structure and Properties of Matter.**

**2. How can the new concept you learned today be applied in your life?**

**Peer Assessment & Self-Assessment**

**Name of all individuals in the group:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_& \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Topic & Title of the group Presentation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

STAR

STAR

WISH – You might consider…

MC900389050[1]

**11) Scoring Rubric for the Final Product**

**Level 1 to 4 evaluation scheme for Structure and Properties Unit – Culminating Activity Assignment Rubric –**Grade 12 Activity to be presented to class for 10-15 minutes

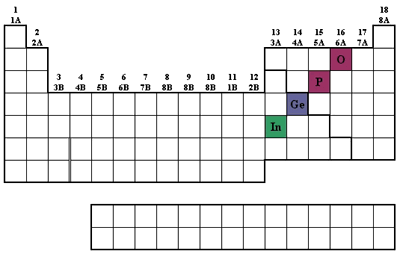
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category / Criteria** | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| **Knowledge and Understanding** | | | | |
| **Knowledge of content**   * Presentation clearly demonstrates at least 2 of the necessary concepts (see General Hand-out) | -demonstrates knowledge of content with intensive support | -demonstrates knowledge of content with limited support | -demonstrates considerable knowledge of content | -demonstrates thorough and extensive knowledge of content |
| **Understanding of content**   * Demonstrates understanding of the presented concepts through the use of specific examples | - understands material with intensive support | - understands material with limited support | * is able to use complex ideas and understand material | * - uses complex ideas thoroughly and effectively |
| **Thinking** | | | | |
| **Use of planning skills**   * Presents material within the required time limits | - presents between 7-8 minutes or 17-18 minutes | - presents between 8-9 minutes or 16-17 minutes | - presents between 9-10 minutes or 15-16 minutes | - presents within 10-15 minutes |
| **Use of processing skills**   * gathered information by using various resources and references them properly | - processes information with intensive support | - processes information with limited support | -is able to process complex information | -is able to process complex information effectively and thoroughly |
| **Use of critical / creative thinking processes**   * creative and analytical process | -uses critical thinking skills with intensive support | -uses critical thinking skills with limited support | -uses complex critical thinking skills | * uses complex critical thinking skills effectively and thoroughly |
| **Communication** | | | | |
| **Expression of ideas through multimedia in oral and written format**  - able to communicate the information in an interesting and dynamic fashion | - communicates with intensive support | -communication is clear, engaging with limited support | -communication is clear, engaging with visuals that are considerably effective | * communication is clear, engaging with visuals that are highly effective stimulating |
| **Organization of ideas**  - is able to organize and express information in an easy to understand manner | - organizes ideas with intensive support | - organizes ideas with limited support | -is able to organize complex ideas | - uses thorough and logical sequence of ideas appropriately |
| **Language Usage**  **-** is able to communicate effectively using diagrams, visuals, and media | - many errors and or omissions (over 10) | - some minor errors and / or omissions (6 to 10) | - minimum minor errors and / or omissions (3 to 6) | -practically no minor errors and /or omissions (under 3) |
| **Application** | | | | |
| **Application**  - is able to connect presented concepts to applications in society   * able to describe and investigate the connection of the lessons learned in class with their presentation choice | - applies knowledge to support position with intensive support | - applies knowledge to support position with limited support | - applies knowledge to support their position | - applies knowledge to support their position thoroughly and effectively |

|  |  |  |
| --- | --- | --- |
| **Knowledge and Skills** | **Mark** | **Equivalent Grade** |
| Knowledge and Understanding |  | / 35 |
| Thinking and Investigation |  | / 35 |
| Communication |  | / 15 |
| Application |  | / 15 |
| **Total Grade** | **/ 100** | |

**Name : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Read through the entire test before beginning. There are 10 pages in total, including the Periodic Table and the electron orbitals chart provided at the end of the test.
* Answer the questions in the spaces provided. If needed, you can use the back of the page, but let me know.
* I wish you all a successful test!

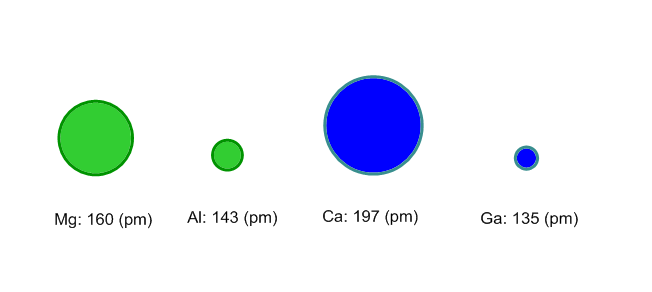
*Knowledge and Understanding (35%)*

1. **Multiple Choice Questions**
   1. Which of these elements is the most electronegative?
      1. Germanium
      2. Indium
      3. Oxygen
      4. Phosphorous
   2. Nonmetals have
      1. Small numbers of electrons in the valence shell and form positive ions.
      2. Large numbers of electrons in the valence shell and form negative ions.
      3. Large numbers of electrons in the valence shell and do not form ions.
      4. Large numbers of electrons in the valence shell and form positive ions.
   3. The ionization energy of an element
      1. is the energy needed to move an electron from the first energy level to the second one
      2. is the energy generated by its nucleus
      3. cannot be calculated or observed
      4. is the energy needed to detach an electron from an elemental atom

**Multiple Choice Questions (continued)**

* 1. The Pauli exclusion principle states that
     1. any atoms with a free *s* orbital can form bonds
     2. no two atoms can occupy the same orbital unless their spins are different
     3. two atoms sharing an orbital are matched exactly
     4. atoms of the same configuration do not change
  2. What is the correct order of the atomic radius in the elements below?
     1. Cl > Al > Mg
     2. Mg > Al > Cl
     3. Al < Mg < Cl
     4. Mg < Al < Cl
     5. Mg < Al > Cl

1. For the following subshells give the values of the quantum numbers (*n*, *l* and *ml*) and the number of orbitals in each subshell:
   1. 4*p* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. 3*d* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. 3*s* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. 5*f* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. 2*p* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Write the ground-state electron configuration for the following elements:
   1. Lithium: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Copper: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Bromine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. Phosphorus: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. Vanadium: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Explain, in terms of electron configuration, why the decrease in atomic radius from Ca to Ga is greater than that from Mg to Al.



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1. Classify the following bonds as ionic, polar covalent or non-polar covalent and draw the corresponding Lewis Diagram:
   1. HCl \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. KF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. the CC bond in H3CCH3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. O2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. MgBr2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Use the VSEPR model to predict the geometry of the following molecules and ions:
   1. AsH3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. OF2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. AlCl4- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. BrF5 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. BF3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Thinking and Investigation (35%)*

1. Imagine that scientists have discovered a new element X, whose atomic number is 120. Write the new element’s electron configuration (full) and indicate its *n* and *l* values for the outermost electron.

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1. Why is the ionization energy required to remove an outer electron from Na+ so much greater than that needed to remove the outer electron from Na? (HINT: if you’re stuck, draw the orbitals of Na and Na+ to help you visualize).

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1. Determine which is most polar and explain your reason for making this choice: nitrogen trifluoride OR phosphorus trifluoride.

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1. In which liquid, HF(l) or H2O(l), will the hydrogen bonds be strongest? Based on this prediction, which of the two liquids will have the highest boiling point?

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*Application (15%)*

Answer **one of the two** following questions.

1. How do you think astronomers utilise the fact that every element has its own distinctive electron configuration?

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1. Frozen water is less dense than liquid water. What would be the effect on Canadian lifestyle if it were not so?

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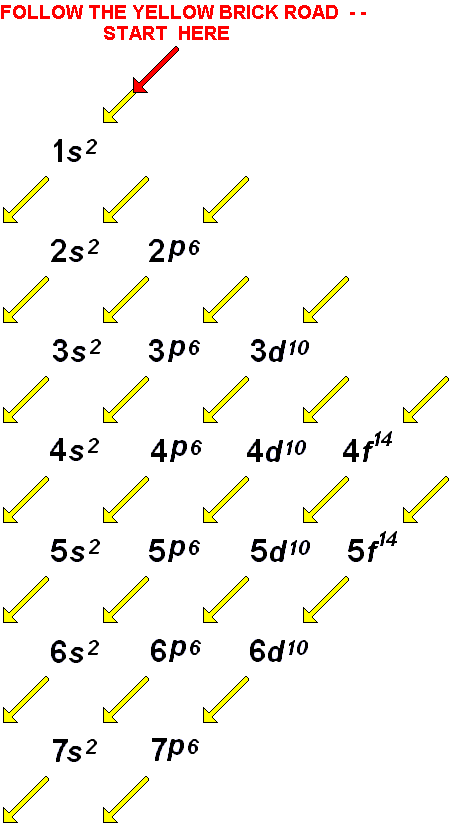
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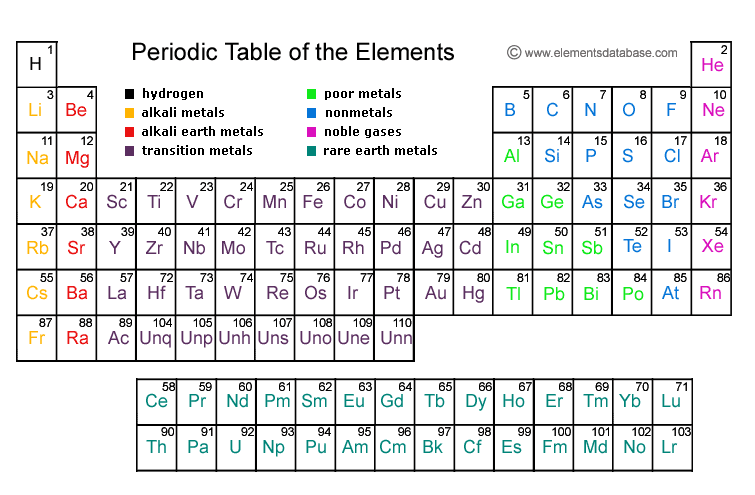
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*Knowledge and Understanding (35%)*

1. a. iii. Oxygen, b. ii. Large numbers of electrons in the valence shell and form negative ions., c. iv. is the energy needed to detach an electron from an elemental atom, d. ii. no two atoms can occupy the same orbital unless their spins are different, e. ii. Mg > Al > Cl

**4 5/5 correct**

**3 4/5 correct**

**2 3/5 correct**

**1 2/5 correct**

**R 1 or 0/5 correct**

2. a. n = 4, l = 1, ml = -1, 0, 1, there are 3 orbitals

b. n = 3, l = 2, ml = -2, -1, 0, 1, 2, there are 5 orbitals

c. n = 3, l = 0, ml = 0, there is 1 orbital

d. n = 5, l = 3, ml = -3, -2, -1, 0, 1, 2, 3, there are 7 orbitals

e. n = 2, l = 1, ml = -1, 0, 1, there are 3 orbitals

**4 5/5 correct**

**3 4/5 correct**

**2 3/5 correct**

**1 2/5 correct**

**R 1 or 0/5 correct**

3. a. [He]2s1, b. [Ar]4s13d10, c. [Ar]4s13d104p5, d. [Ne]3s23p3, e. [Ar]4s23d3

**4 5/5 correct**

**3 4/5 correct**

**2 3/5 correct**

**1 2/5 correct**

**R 1 or 0/5 correct**

3. The decrease in atomic radius from Ca to Ga is much larger than the decrease in atomic radius from Mg to Al because there is the entire 3d suborbital level that is not present between Mg and Al.

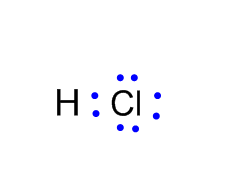
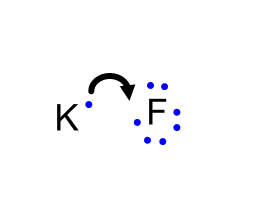
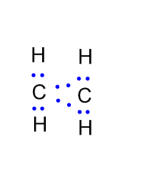
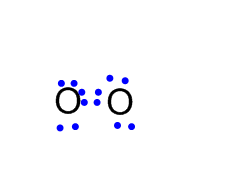
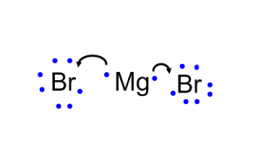
**4 if mention the full 3d suborbital level**

**3 if mentions the 3d suborbital level**

**2 if mentions a layer of electrons**

**1 if mentions Ga has more electrons**

**R otherwise (use judgement)**

4. a. polar covalent, b. ionic , c. non-polar covalent , d. non-polar covalent, e. ionic 

**4 5/5 correct**

**3 4/5 correct**

**2 3/5 correct**

**1 2/5 correct**

**R 1 or 0/5 correct**

5. a. trigonal pyramidal, b. bent, c. tetrahedral, d. square pyramidal, e. trigonal planar

**4 5/5 correct**

**3 4/5 correct**

**2 3/5 correct**

**1 2/5 correct**

**R 1 or 0/5 correct**

*Thinking and Investigation (35%)*

6. For 120 electrons, 1s2 2s2 2p6 3s2 3p6 4s2 3d10 4p6 5s2 4d10 5p6 6s2 4f14 5d10 6p6 7s2 5f14 6d10 7p6 8s2, n = 8, l = 0

**4 All three components correct**

**3 *n* and *l* correct, but a minor error in the electron configuration**

**2 one error between the *n*, *l* or the electron configuration**

**1 two errors between the *n*, *l* or the electron configuration**

7. When sodium is ionized, its one typical valence electron has been removed. With it gone, the remaining electrons are made up of filled shells, with a similar stability to neon. Since the electrons are in filled electron shells, it is much more difficult to separate them.

**4 If mentions:**

**- removal of the sole valence electron**

**- remaining electrons make filled electron shells**

**- Na+ has the same electron configuration as stable neon**

**- it is very difficult to remove an electron from a filled shell**

**3 if mentions 3 of those 4 topics**

**2 if mentions 2 of those 4 topics**

**1 if mentions 1 of those 4 topics**

8. Phosphorus trifluoride is more polar. Both are polar and equally symmetric, but the difference in electronegativity between N-F is less than between P-F.

**4 If mentions:**

**- that phosphorus trifluoride is more polar.**

**- that both compounds are polar**

**- that they are equally symmetric**

**- that the difference in electronegativity between N-F is less**

**than between P-F.**

**3 if mentions 3 of those 4 topics**

**2 if mentions 2 of those 4 topics**

**1 if mentions 1 of those 4 topics**

9. The hydrogen bonding is strongest in water; therefore it has a higher boiling point. Even though fluorine is more electronegative than oxygen, the water molecule can possess four separate hydrogen bonds, making it more tightly bound.

**4 If mentions:**

**- water has the highest hydrogen bond**

**- water, therefore, has the higher boiling point**

**- fluorine IS more electronegative, so HF is more polar**

**- water can possess more hydrogen bonds**

**3 if mentions 3 of those 4 topics**

**2 if mentions 2 of those 4 topics**

**1 if mentions 1 of those 4 topics**

*Application (15%)*

10. The fact that every element’s electron configuration is unique creates the well-known electron emission spectra, each element’s own fingerprint. With this spectra recorded, astronomers can analyse light coming from an object in space (for example, a star) and determine the chemical composition of this object.

**4 If mentions:**

**- the electron emission spectra**

**- each element’s spectra is unique**

**- with this information, astronomers can determine the**

**chemical composition of stars.**

**3 if mentions 2 of those 3 topics**

**2 if mentions 1 of those 3 topics**

**1 if doesn’t explicitly mention one of these ideas, but alludes to them,**

**or else gives a possible explanation.**

11. Because frozen water has the peculiar property of being less dense than its liquid counterpart, the ice floats on liquid water. Because of this, bodies of water freeze from the top, rather than from the bottom. This layer of ice acts as insulation and helps slow the total freezing of the water. Since some of the water under the ice is still liquid, the eco-system survives under the ice (the fish don’t freeze). It also lets us go skating!

**4 If mentions:**

**- that ice floats**

**- bodies of water freeze from the top**

**- this ice acts as an insulating blanket, keeping the water**

**underneath from completely freezing.**

**- the life under the ice doesn’t freeze completely.**

**3 if mentions 3 of those 4 topics**

**2 if mentions 2 of those 4 topics**

**1 if mentions 1 of those 4 topics**

*Communication (15%)*

The communication is evaluated based on the quality of the student’s writing. Spelling errors and lack of clarity is noticed.

**4 almost no errors and very clear phrases**

**3 a few errors or minor lack of clarity**

**2 a few errors and lack of clarity**

**1 many errors and a lack of clarity**

**References used:**

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